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Tunable atomic arrangements of platinum catalysts for the nucleation of single-wall carbon nanotubes

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ABSTRACT

The inhomogeneous chiral structure of single-wall carbon nanotubes (SWCNTs) is the major challenge for implementing their real applications in nano-electronics. The assembly of carbon hexagonal network strongly replies on catalyst-tube interfacial properties and the diffusion dynamics of carbon atoms around catalysts. In order to control over the assemble processes, here we realized the growth of SWCNTs from platinum nanoparticle as a catalyst with a low pressure of ethanol, its activity and stability under different atmospheres were explored inside environmental transmission electron microscope with high spatial and temporal resolution. It was found that the activity of platinum can be changed with a decreased surface-to-volume ratio under different atmospheres: Ar>O_2>Vacuum>H_2. Especially, a single-atomic-layer of platinum particle formed on MgO support allows us to observe the formation of monolayer graphene and its lift-off to a cap of SWCNT. The evolution processes of nanoparticles were also followed during multiple

nucleation of SWCNTs to show these interfacial interactions. This direct evidence provides us an in-depth understanding on the choice of pt-based catalysts for controlling the structure of SWCNTs.